

same gas is hydrogen when combined with negative electricity."

Now, although it is not our practice to "halloo before we are out of the wind," so impressed are we with a persuasion that Mr. Paine's pretensions are well founded, that we think it worth while, as a mere act of justice to our own penetration, and as a corroborative of the probabilities in favour of these very pretensions, to revert to what we anticipated on these same points in July last, when the whole subject was designedly enveloped in more mysterious hints and indefinite obscurity:—

"We will venture to anticipate that if Mr. Paine have really tested and proved the truth of Macvicar's idea of the constitution of water, as resolvable into hydrogen, it must be by negative electricity (the singular affinity of which to the radiant actinism of the solar ray we have already noted in the *Tax Bazaar*); that he eliminates the *Aydragen*. A word to the wise in time may save us, at least, if not the Americans, from the private appropriation of so great and universal an idea under patent lock and key. And to this end we would further hint that by connecting the whole series of zinc plates in a galvanic battery with a separate and isolated trough containing sulphur, a high electro-negative, we long ago obtained decided manifestations of electrical action in the clustering of the sulphur round the single pole or wire communicating with the series of zinc plates while the ordinary galvanic circle was closed and the trough in action. Other pursuits prevented, as they still do, any further investigation of this peculiar train of experiment, but it seems to bear on the subject."

Here we not only distinctly anticipated the precise agency, namely, the negative force of electricity, employed by Mr. Paine in the elimination of hydrogen from water, but made a bold dash at the *modus operandi*, by showing how we had, on one occasion, endeavoured to obtain the operation of the negative so far separated from the usual circuit.†

Moreover, in another passage (vol. viii. p. 357) we further remarked that "it will probably be

* In order to make this intelligible to readers who may not have perceived that we have already said on the subject in former numbers of this journal, we may here quote from a note by us at page 337, vol. viii. (13th July, 1850):—"We have learnt that Mr. Paine, the alleged discoverer or inventor of the process, holds some peculiar ideas on the constitution of water. If we understand it aright, he regards water as an element, at least as much as the oxygen eliminated from it, and alleges that either oxygen or hydrogen may be so eliminated, as either may be desired, by special electrical action. If such be Mr. Paine's idea, and if so wonderful a result have really been obtained by setting such an idea on foot, we must claim the original merit of this idea for a fellow countryman, Macvicar, of St. Andrews, who, at least twenty years since, wrote a curious treatise on chemistry, based on this and other original principles. Hydrogen, according to Macvicar, is the most elementary of all substances except "radiant matter" (and in this, indeed, Davy himself appears to have to some extent concurred). The form of its atoms or particles is the most elementary or simplest as well as most active of all possible corporeal forms, namely, the tetrahedron. Oxygen, water, and all other substances are composed of these tetrahedra united by electrical affinity in various modes and numbers constituting compounds or quasi-elementary atoms or molecules. Water, then, is either solely hydrogen (when entirely resolved into an electric medium of tetrahedra), or partly hydrogen and partly oxygen (when some of these hydrogenous atoms remain in the closer conjunction constituting the oxygenous waters). (And as such ideas may appear to a mere exoteric chemist, as we have heard Macvicar speak of most respectfully by a chemist of celebrity in his day, and himself a respected correspondent of Davy and Faraday, namely, Kepp.) We may be content to take an opportunity of quoting Macvicar himself on this point.

† We are perfectly aware of the doubts entertained by some of the soundest and most able electricians, whether it is at all possible, by any means whatever, so to separate the negative from the positive, or, in any way to obtain the predominant operation of the one, even with the crippled or diminished operation of the other. The great importance of the question, however, is admitted on all hands, as will appear from the following remarks on this subject by Dr. Faraday himself.—"The prince of electricians, who thinks it 'impossible to separate a current of positive or current of negative force alone' [quote here, however, that in Mr. Paine's break of the current we cannot be said to have either force alone, but only either preponderant], a modification of Dr. Faraday's impossibility which would have recommended it to the with Mr. Paine's alleged fact, had not the doctor gone on to say]—or of the two at once, with any preponderance of one over the other? yet he believes that 'the simultaneousness of this truth, if, as I think (he says), it be a truth, or, on the other hand, the disproof of it, is of the greatest consequence.'" (Experimental Researches in Electricity, p. 519). "If, as a first principle," he adds, "we can establish that the centres of the two forces, or elements of force, never can be separated to any sensible distance, or at all events not further than the space between two contiguous particles, or if we can establish the contrary conclusion, how much clearer is our view of what lies before us and how much less embarrassing the ground over which we have to pass in attaining to it, than if we remain halting between two opinions. And with that feeling we readily test every experiment which bears upon the point as far as our present facilities of testing of permitting them, with a theoretical expression, to point too only every, and we not much more likely to attain to the real truth, and

found that not only the electric force, but the magnetic also, is at work in the composition of both oxygen and water, and that hence the diamagnetic force was less than the actinic or at least electro-negative must be brought into play in their demolecularisation or decomposition." And we are now confirmed in that opinion by the nature of Mr. Paine's machine.

On the principles or leading ideas whence we derived the possibility of anticipating such discoveries, and which ideas, by virtue of such possibilities, become themselves of practical importance, we may have something further to say; but in the meantime we must conclude our account of Mr. Paine's invention. This we will do as briefly as possible in the words of those who have witnessed its alleged astonishing operation.

"The apparatus consists of four pieces, all placed upon a pine table or shelf, and in no ways connected with anything else.

First.—A common magneto-electric machine, consisting of two permanent horse-shoe magnets, about twelve inches long: these were placed horizontally on a mahogany frame, about four inches apart, one being placed above the other. Between the ends of these magnets were a pair of helices, and these are attached to a wheel above that they could be set into a rapid rotary motion. The peculiar construction of these helices, from which the immensely-increased power is said to be obtained, I will hereafter describe.

Second.—A large open-mouthed glass jar, capable of holding twelve quarts: this was a little more than half filled with water. (We tested the water, to satisfy ourselves that it was water.) Within this jar was placed a common bell glass, open at the bottom, and reaching within four inches of the bottom of the large jar. The top of the bell glass was closed tightly with a brass cap, which extended over it, so as to rest upon the sides of the outer jar. Passing through the cap of the bell glass were two wires, which extended nearly down to the bottom of the bell glass, and these terminated in a circular metallic box, 1½ inch long, and 1 inch in diameter: this box was hollow, and perforated with small holes in the upper part. The electrodes, or points of connection between the poles, were in this box. The water in the jar and bell glass reached some 6 inches above the electrodes.

Third.—A quart glass jar, half filled with spirits of turpentine: a tube or gaspipe passed from the top of the bell glass above mentioned, and into this jar of turpentine, terminating at the bottom of the turpentine. From the cap which covered the jar of turpentine, another tube or gaspipe passed to a jet or burner about 12 inches from the jar.

Fourth.—A common glass tumbler, half filled with water.

The above comprised all the apparatus used by Mr. Paine, with the exception of three wires, or rather flat strips of copper, by which he connected the magneto-electric machine with the jar of water."

The use of the glass of water, and the arrangement of the wires, we have already indicated. In respect to the helices, it is said—

"From that proceed with safety to the present instance. I say these things not, I hope, to advocate a particular view, but to draw the strict attention of those who are able to investigate and judge of the matter to what must be a turning point in the theory of electricity, to a separation of two roads, one only of which can be right. . . . If a unipolar body could exist, i. e. one that could conduct the one electricity and not the other, what very new characters we should have a right to expect in the currents of single electricity passing through them! and how greatly ought they to differ not only from the common current which is supposed to have both electricities travelling in opposite directions in equal amount at the same time, but also from each other!" Is it not to be deeply regretted, whatever be the merits of Mr. Paine's discovery, that such a man as Faraday should have seen reasons to believe in the merely negative conclusion that such a power of using at least a preponderance of the one force was impossible?

† In respect to these, and once for all to the operative result of the whole, we may here quote from the *Eastern Chronicle*:—"The power of this simple arrangement to evolve electricity is tremendous. The electrical force compared with the mechanical cause is like that of the rush of water which carries the wheel of a great cotton factory compared with the effort of a child who may hold the gate. At each discharge of the helices, and there are many in a second, according to the rapidity, an abundant crop of gas bubbles is produced; and this, owing partly to the peculiar construction of the electrode, or form of the poles where presented in proximity to each other in the water of the jar. This electrode is a point of great interest, and it is just at this point that the mighty and mysterious fluid, so potentially commanded and propelled by helices, may prove too big for its harness, and show its relationship to the favourite weapons of Jove. Here is a stupendous difficulty which has taxed the courage and inventive genius of Mr. Paine—a difficulty of which the public could not be aware, and which seems to account for much delay. He has turned the thunderbolt in this delicate point, at least so far as to ensure perfect safety with due care. Other safeguards may yet be added. However, it is not right to say, that it could not be strange if circumstances and temerity should hereafter meet with a fate here that will be a caution to all."

"Mr. Paine claims that by an improved construction of the helices in the magneto-electric machine he has improved the power of that instrument immensely, say ten thousandfold, sufficient to produce the wonderful results above described. The peculiar construction of these helices was shown to us, and explained. Before describing them I should make a remark respecting the ordinary helices of a magneto-electric machine. It is well known that the power of a magneto-electric machine, with the ordinary helices, up to a certain point, depends upon the amount of surface of insulated copper-wire in the helices. It is only upon the surface of this wire that the electricity can be conducted. Mr. Paine's helices differ from the above in this, that the wire which forms the coil is made hollow, being formed by twisting or winding very thin strips of copper, forming it into a tube. This wire or tube is then covered with India-rubber or gutta percha, to insulate it, and then filled with water. This water within the wire, forming the helices, is so arranged as to be brought in contact with the current of electricity induced from the magnets—in the same manner as the wire that surrounds it. Faraday has established the fact that a very small quantity of water is capable of containing a vast amount of electricity—I think he says that a single drop of water will contain as much electricity as a thunder-cloud—sufficient to burst off the gable end of a house. Just in proportion as the power of the helices is increased to induce or receive the electric current, so is its power increased to give it off. . . . The experiments which we saw, and in which I think we could not be mistaken, would go to show the claim of Mr. Paine to be well founded."

PROFESSOR COCKERELL'S FIFTH LECTURE ON ARCHITECTURE.

Two great architects of Greece, great as they were in the practice of the art, were not content without a knowledge of the theoretical laws. The Italians, who followed, were satisfied with practice and precepts, without theory. Through Vitruvius we learn that the Greeks well understood the utility of this course of study, particularly of symmetry, notwithstanding the confusion of this uncalculated mind, where he sometimes appears as if in borrowed planes. Dr. Johnson is not very clear in his definition of symmetry. According to the Greeks it had a double signification: firstly, like the proportionate size of the arms and legs to the human body; and, secondly, commensuration—a principle, by the bye, no less remarkable in Greek art than in Gothic. Commensuration is the great feature of the building for the Exhibition in Hyde Park: we all know that every proportion in it is a multiple of eight. The profession, said he, had the opportunity the day before this lecture of being present in the interior of the so-called Crystal Palace, when the noble, the wealthy, and the learned of the United Kingdom—the members of both Houses of Parliament—were present. Their admiration of the symmetrical was great, indeed: it was the commensuration of great numbers of similar forms that gave delight (and he mentioned this with the highest respect) to their common eyes! William of Wykeham especially formed his designs for the ground plans of the edifices he erected upon the equality of spaces, or multiples of them, as he exhibited diagrams illustrated.

Eurythmia, the good rhythm, or harmonious proportion, was the next great element of architectural design to be studied. Symmetry may be defined as the parity of parts; commensuration, the exact proportion of parts to each other, or symmetry of quantities. Eurythmia, or proportion, is evident, especially in the Greek profiles of entablatures, as the examples exhibited proved, where the elegant and chaste union of curvilinear with straight lines was productive of the greatest beauty. The human form was the finest example in nature for commensuration, a man with his arms extended being exactly the same in width as his height. Vitruvius, in his third book, says, the human form divine in all perfection. In the lower animals there is no such proportion, as may be observed in the baboon. There may be cited three kinds of form in man, as the tall, the robust, and the middling, each of which possessed a peculiar beauty in itself, and in all ages, these three types have been admirably employed in ancient art to a suitable indication—but now a day, we cannot